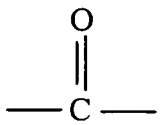
REMARKS

STATUS OF THE CLAIMS:

With the above amendments, claim 3 has been cancelled, claims 1, 5, 9, 11, 13 and 17 have been amended, and claims 18-19 have been added. No new matter has been added by way of the above amendments. Support for the amendment to claim 1 comes from page 9, second full paragraph, from original claim 3, and from page 7, line 22. The amendments to claims 11, 13 and 17 have support on page 16, lines 11-12. The amendments to all other claims are amendments made at the suggestion of the Examiner and are non-narrowing in scope. Reconsideration is respectfully requested in light of the following remarks.

SPECIFICATION OBJECTIONS

The Examiner asserts that it is unknown what is meant by the use of " > " and " " in the specification (as well as the claims). As a point of clarification, the " " refers to an atom that has three substituents attached to that atom. Likewise, " > " refers to an atom that has two substituents attached thereto. For example, ">C=O" is defined as: 

(*i.e.*, a carbon having four bonds). Accordingly, Applicants submit that with the above description and the disclosure in the specification at pages 6-7, etc., the various symbols are fully

understandable. Withdrawal of the objection is warranted and respectfully requested.

The Examiner further asserts that it is unknown what is meant by "Φ". The Examiner's attention is drawn to page 23, for example, line 15, wherein "Φ" is defined. "Φ" means "diameter". Accordingly, with the description on page 23 of the specification, one of skill in the art would readily understand what is meant by this term. Withdrawal of the objection is warranted and respectfully requested.

Rejections Under 35 U.S.C. § 112, Second Paragraph

Claims 1-17 have been rejected under 35 U.S.C. § 112, second paragraph as being indefinite.

Claims 1, 3, and 5 have been rejected for the use of the phrase "capable of trapping". Claim 3 has been cancelled so the rejection is moot with respect to claim 3.

With regard to claims 1 and 5, the Examiner's suggestion has been adopted, and the phrase "capable of trapping" has been replaced by the phrase "that traps". Applicants believe that with this amendment the rejection has been obviated.

Claim 3 has also been rejected for the use of the symbols " $\rightarrow$ " and " > ". As explained above, " $\rightarrow$ " and " > " refer to an atom that has three substituents attached to the atom and two substituents attached to the atom, respectively. It is believed that with this

explanation, that the claims are no longer vague nor indefinite. Withdrawal of the rejection is warranted and respectfully requested.

Claim 9 has been rejected for reciting the milling of an ion exchange resin yet it is dependent from a claim that recites milling of a chelate resin (i.e., claim 7). Claim 9 has been amended to depend from claim 5. Applicants believe that with this amendment that the rejection has been obviated. Withdrawal of the rejection is warranted and respectfully requested.

Claims 11, 13, and 17 have been rejected for using the phrase "copper-based metal". Claims 11, 13, and 17 have been amended to recite "wherein the metal is copper or copper alloy", which has support at page 16, lines 11-12. Applicants believe that with this amendment, the rejection has been obviated. Withdrawal of the rejection is warranted and respectfully requested.

Claim 15 has been rejected for reciting a "spherical particle", which the Examiner asserts is indefinite. Applicants traverse. The Examiner's attention is drawn to page 14, lines 12-21, wherein it is described what is meant by a "spherical particle" and how this is not of the same scope as the particle disclosed in claim 1 (from which claim 15 ultimately depends). Withdrawal of the rejection is warranted and respectfully requested.

Claim Objections

The Examiner has objected to claims 11 and 13 under 37 C.F.R. § 1.75(c) for improper dependency due to an alleged failure to limit the subject matter of the previous claim by not further limiting the abrasive of claim 1 or the polishing composition of claim 12. Applicants traverse.

Applicants assert that claims 11 and 13 further limit the subject matter of claim 1, because these claims restrict a metal applied by the present abrasive to a copper or copper alloy. Accordingly, the objection is inapposite. Withdrawal of the objection is warranted and respectfully requested.

Rejections under 35 U.S.C. §§ 102(a), (b), (e) and 103

Claims 1-3 and 11 are rejected under 35 U.S.C. § 102(b) as being anticipated by or in the alternative under 35 U.S.C. § 103(a) as being unpatentable over any of 1) Farkas '444 (US Patent No. 5,614,444), 2) Allman '055 (US Patent No. 5,861,055), or 3) Muroyama '588 (US Patent No. 5,709,588).

Claims 1-3 and 11 are rejected under 35 U.S.C. § 102(a) or (e) as being anticipated by or in the alternative under 35 U.S.C. § 103(a) as being unpatentable over any of 1) Hosali '741 (US Patent No. 6,042,741), 2) Izumi '400 (US Patent No. 6,022,400), or 3) Kasai '003 (US Patent No. 6,372,003).

Claims 12-17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over any of 1) Farkas '444, 2) Allman '055, or 3) Muroyama '588, 4) Hosali '741, 5) Izumi '400, or 6) Kasai '003 all in view of Kaufman '306 (US Patent No. 6,063,306).

Claims 1-3, 11-14 and 16-17 are rejected under 35 U.S.C. § 102(b) as being anticipated by or in the alternative under 35 U.S.C. § 103(a) as being unpatentable over Brancaleoni '606 (US Patent No. 5,476,606).

Claim 15 is rejected under 35 U.S.C. § 103(a) as being unpatentable over Brancaleoni '606 in view of Kaufman '306.

Claims 1-3, 11-14 and 16-17 are rejected under 35 U.S.C. § 102(b) as being anticipated by or in the alternative under 35 U.S.C. § 103(a) as being unpatentable over JP '647 (JP 11-188647).

Claims 5 and 7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '647.

These rejections are traversed for the following reasons.

Present Invention

The present invention relates to an abrasive for metal comprising a polymer particle having a functional group that traps a metal ion, wherein the functional group that traps a metal ion is at least one selected from the group consisting of -OH, -COOM, >C=O, -O-, $-CONH_2$, -NO, $-NO_2$, $\rightarrow N\rightarrow O$, $-SO_3M$, -PHO(OM), $-PO(OM)_2$, $-AsO(OM)_2$, $-NH_2$, >NH, $\rightarrow N$, -N=N-, >C=N-, >C=N-OH, >C=NH, -SCN, -SH, -S-, >C=S,

-COSM, -CSSM, $-CSNH_2$, -NCS, >P-, >As-, -SeH, >C=Se, and -CseSeM, wherein M represents hydrogen, an alkali metal, an alkaline earth metal or an ammonium group and R represents a hydrocarbon.

Disclosure of Farkas '444

Farkas '444 discloses a method of using additives with silica-based slurries to enhance metal selectivity in polishing metallic materials utilizing a chemical-mechanical polishing (CMP) process. The additives are used with silica-based slurries to passivate a dielectric surface, such as a silicon dioxide (SiO_2) surface, of a semiconductor wafer so that dielectric removal rate is reduced when CMP is applied. The additive is comprised of at least a polar component and an apolar component. The additive interacts with the surface silanol group of the SiO_2 surface to inhibit particles of the silica-based slurry from interacting with hydroxyl molecules of the surface silanol group. By applying a surface passivation layer on the SiO_2 surface, erosion of the SiO_2 surface is reduced. However, the metallic surface is not influenced significantly by the additive, so that the selectivity of metal removal over oxide removal is enhanced.

Farkas '444 fails to disclose non-silica based slurries. Farkas '444 also fails to disclose it is the particles that have functional groups.

Disclosure of Allman '055

Allman '055 discloses a polishing composition which includes (1) a polishing media particle; (2) a film forming binder for suspending the particle and forming a temporary film on an exposed surface of the workpiece. The temporary film is dissolvable in a subsequently applied polishing wash, whereby the polishing media particle is freed to polish the workpiece. Further, the composition contains (3) a solvent for suspending the polishing media particle in the film forming binder to facilitate forming the temporary film; and (4) a wetting agent to improve the wettability of the composition on the exposed surface of the workpiece.

Allman '055 fails to disclose particles that have organic functionalities.

Disclosure of Muroyama '588

Muroyama '588 discloses a polishing slurry used for a process of polishing a workpiece by bringing the workpiece in sliding-contact with a polishing plate supplied with the slurry, and a polishing process using the slurry. The slurry includes polishing particles treated with a surface-finishing agent having at least a carboxyl group containing material, an amino group containing material, and a sulfonic acid group containing material. The slurry is can be used to polish a workpiece without the occurrence of scratches on the surface of the workpiece.

Muroyama '588 fails to disclose any non silicon containing particles.

Disclosure of Hosali '741

Hosali '741 discloses a composition for polishing a composite comprised of silica and silicon nitride comprising: an aqueous medium, abrasive particles, a surfactant, and a compound which complexes with the silica and silicon nitride. The complexing agent has two or more functional groups each having a dissociable proton with the functional groups being the same or different.

Hosali '741 fails to disclose any particles that are not inorganic particles.

Disclosure of Izumi '400

Izumi '400 discloses polishing surfaces of substrates, typically semiconductor device substrates, with a polishing agent comprising polishing abrasive grains of a metal oxide (e.g. cerium oxide, zirconium oxide or manganese oxide) having a hydrophilic surface and a surface potential (zeta potential) of not more than 50 mV at pH 7 in absolute value. The polishing abrasive grains preferably have hydrophilic groups, (preferably hydroxyl groups), at the extremities. After polishing, the surfaces of substrates are then cleaned with an aqueous cleaning solution comprising pure water. The polishing abrasive grains remain on the polished substrate surface and can be

removed to a satisfactory degree therefrom by simple cleaning using the aqueous cleaning solution only.

Izumi '400 fails to disclose any particles that are not inorganic particles.

Disclosure of Kasai '003

Kasai '003 discloses a process for producing crystalline ceric oxide particles having a particle diameter of 0.005 to 5 m. The process comprises the steps of reacting a cerium (III) salt with an alkaline substance in an $(OH)/(Ce^{3+})$ molar ratio of 3 to 30 in an aqueous medium in an inert gas atmosphere to produce a suspension of cerium (III) hydroxide. The process then comprises blowing oxygen or a gas containing oxygen into the suspension at a temperature of 10 to 95°C and at an atmospheric pressure.

Kasai '003 fails to disclose any particles that are not inorganic particles.

Disclosure of Kaufman '306

Kaufman '306 discloses a first CMP slurry including an abrasive, an oxidizing agent, a complexing agent, a film forming agent and an organic amino compound, and a second polishing slurry including an abrasive, an oxidizing agent, and acetic acid. The weight ratio of the oxidizing agent to acetic acid is at least 10. Kaufman '306 also discloses a method for using the first and second polishing slurries

sequentially to polish a substrate containing copper and containing tantalum or tantalum nitride or both tantalum and tantalum nitride.

Kaufman '306 fails to disclose any particles that are not inorganic particles.

Disclosure of JP '647

JP '647 discloses a polishing layer comprising abrasive particles and binder. The abrasive has a specific range of Moh's hardness and a specific particle size and the binder has a functional group trapping metal ion.

In column 2, lines 26-30, it is shown that silica, zirconia, titania ceria, iron oxide and garnett are preferably used. These abrasives are inorganic and have no functional group.

JP '647 fails to disclose any particles that are not inorganic particles.

Removal of the Rejections over Farkas '444, Allman '055, Muroyama '588, Hosali '741, Izumi '400, Kasai '003, Kaufman '306, Brancaleoni '606, and JP '647

The differences between the present invention and References cited by the Examiner are as follows.

None of the references disclose any of the functional groups as are claimed in instantly pending claim 1. Accordingly, none of the references can render obvious the instant invention because they fail

to disclose the elements of the instant invention. For this reason alone, withdrawal of the rejection is warranted and respectfully requested. Further, all of the references have other differences as are outlined below.

Farkas '444 discloses an aqueous slurry and a chemical additive having a polar component and an apolar component introduced into the slurry. As is described in column 2, lines 58-61, the slurry used in Farkas '444 is a silica-based slurry. Therefore, the slurry disclosed in Farkas '444 is that of inorganic particles.

Moreover, in Farkas '444, it is the chemical additives that have functional groups, and not the particles themselves as is claimed in instantly pending claim 1.

Hosali '741 discloses a composition for polishing a composite comprised of silica and silicon nitride comprising an aqueous medium, abrasive particles, a surfactant and a compound which complexes with the silica and silicon nitride.

In column 2, lines 59-64, it is disclosed that ceria, alumina, zirconia, silica, titania and barium carbonate could be used as polishing abrasives. Therefore, the polishing abrasives used in Hosali '741 are inorganic particles. Further, these abrasives have no functional group on them as is claimed in instantly pending claim 1.

Kaufman '306 discloses a chemical mechanical polishing slurry precursor comprising at least one abrasive and at least one organic

compound selected from long chain alkylamines, alcoholamines and mixtures thereof, and at least one complexing agent.

In column 9, lines 26-35, the abrasive used by Kaufman '306 is a metal oxide including alumina, titania, zirconia, germania, silica, ceria and mixtures thereof and these abrasives are inorganic particles and have no functional group. Therefore, Kaufman '306 fails to disclose the elements that are claimed in instantly pending claim 1.

JP '647 discloses a polishing layer comprising abrasive particles and binder. The abrasive has a specific range of Moh's hardness and a specific particle size and the binder has a functional group trapping metal ion.

does not disclose poly particles

In column 2, lines 26-30, it is shown that silica, zirconia, titania ceria, iron oxide and garnett are preferably used. These abrasives are inorganic and have no functional groups as is claimed in instantly pending claim 1.

Allman '055 discloses that polishing media particles are selected from the group consisting of silica, calcium oxide, aluminum oxide, silicon nitride, silicon carbide, cesium oxide, natural and synthetic diamond, metal silicides, tungsten oxide, titanium nitride, titanium oxide. These particles are also inorganic particles. Allman '055 fails to disclose the functional groups that are claimed in instantly pending claim 1.

Moreover, the polishing composition disclosed by Allman '055 include a film forming binder for suspending the particles and forming a temporary film on the target substrate.

Izumi '400 merely discloses inorganic particles as an abrasive and not the functional groups that are claimed in instantly pending claim 1.

Kasai '003 discloses ceric oxide particles as abrasive. As with all the other references cited by the Examiner, these are inorganic particles. Kasai '003 fails to disclose the functional groups that are claimed in instantly pending claim 1.

While Muroyama '588 is silent about the kind of polishing particles that are used, in column 2, lines 16-20, Muroyama '588 describes that there is a fear that "scratches" occur on an interconnection layer and interlayer dielectric film due to aggregates of fine particles of silicon oxide. Morevoer, in column 2, lines 21-26 Muroyama '588 describes that an object of the invention is to provide a slurry having polishing particles simply surface-treated, which are capable of stably polishing an interlayer dielectric film and a metal interconnection layer while the occurrence of scratches on the surfaces are suppressed.

From these descriptions, it should be apparent to one of ordinary skill in the art that the invention disclosed by Muroyama '588 relates to silicone oxide as polishing particles. As further

proof of this, Muroyama '588 uses silicon oxide as the polishing particles in every Experiment.

Therefore, one of ordinary skill in the art would recognize that the polishing particles in Muroyama '588 are inorganic particles.

In contrast to all of the above references, the particles of the present invention are polymer particles wherein each polymer particle has functional groups capable of trapping a metal ion. An examples of these polymer particles is an ion exchange resin.

Accordingly, all of the cited references are different from the present invention as to particle used as abrasive. Further, all of the references do not disclose or suggest using polymer particles as abrasive, and in particular, none of the references disclose or suggest using polymer particles having a functional group capable of trapping a metal ion.

Some of the cited references do disclose the use of particles in combination with additives having a functional group. However, the polymer particle of the instant invention has a functional group capable of trapping metal ion as claimed in the present invention that is much more effective for suppressing etching rates. Accordingly, even if the references had disclosed all of the elements of the instant invention (which Applicants do not concede), the instant invention discloses unexpectedly superior results.

As proof of this, please find the attached 37 CFR §1.132 declaration that shows these superior properties. In particular, the

Examiner's attention is drawn to the differences between Experimental 1 and 2 on page 2 of the declaration. One of ordinary skill in the art would readily see that all of the cited references fail to disclose or teach the effect of etching that is seen in the polymer particles that are claimed in the present invention.

In view of foregoing, it should be apparent to one of ordinary skill in the art that the present invention is not anticipated by nor can it be rendered obvious by any of the cited references or any combination thereof.

Conclusion

With the above remarks and amendments, it is believed that the claims, as they now stand, define patentable subject matter such that a passage of the instant invention to allowance is warranted. A Notice to that effect is earnestly solicited.

If any questions remain regarding the above matters, please contact Applicant's representative, Eugene Perez (Reg. No. 48,501), in the Washington metropolitan area at the phone number listed below.

Pursuant to 37 C.F.R. § 1.17 and 1.136(a), Applicants respectfully petition a one (1) month extension of time for filing a response in connection with the present application. The required fee of $110.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By _____
John W. Bailey, #32,881

JWB/TBS/

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Attachments:
Version with Markings to Show Changes Made
37 C.F.R. § 1.132 Declaration

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE ABSTRACT OF THE DISCLOSURE:

The Abstract has been replaced with the Abstract attached hereto.

IN THE WRITTEN DESCRIPTION:

The paragraph starting at page 1, line 13 has been amended as follows.

--In recent years, various fine processing techniques have been researched and developed for advanced high integration and high performance of LSI wherein LSI stands for "Large Scale Integration". Among them, the chemical mechanical polishing (hereafter, may be abbreviated as CMP) has been attracting the attention. CMP is a composite technique involving a chemical action and a mechanical action between a polishing composition and a material to be polished. It is an essential technique in the planarizing of insulating interlayers, particularly in the multilayer wiring formation step, in the metal plug formation, in the buried-type metal wiring formation and the like.--

The paragraph starting at page 8, line 20 has been amended as follows.

--The functional group capable of trapping a metal ion preferably exists on the surface of the particle. Even if the group

does not exist on the surface of the particle, the same effect can be obtained when the functional group capable of trapping a metal ion can appear on the surface of the particle and can contact with a metal to be polished by crushing of the particle due to stress on polishing, by [pealing] peeling of a coating film or by other situations.--

IN THE CLAIMS:

The claims have been amended as follows.

1. (Amended) An abrasive for metal comprising a polymer particle having a functional group [capable of trapping] that traps a metal ion, wherein the functional group that traps a metal ion is at least one selected from the group consisting of -OH, -COOM, >C=O, -O-, $-CONH_2$, -NO, $-NO_2$, $\rightarrow N\rightarrow O$, $-SO_3M$, -PHO(OM), $-PO(OM)_2$, $-AsO(OM)_2$, $-NH_2$, >NH, $\rightarrow N$, -N=N-, >C=N-, >C=N-OH, >C=NH, -SCN, -SH, -S-, >C=S, -COSM, -CSSM, $-CSNH_2$, -NCS, >P-, >As-, -CeH, >C=Se, and -CseSeM, wherein M represents hydrogen, an alkali metal, an alkaline earth metal or an ammonium group and R represents a hydrocarbon.

5. (Amended) The abrasive for metal according to claim 1, wherein the particle having a functional group [capable of trapping] that traps a metal ion is a particle comprising an ion exchange resin, and the average particle diameter of the particle is 1.0 μm or less.

9. (Amended) A process for producing the abrasive for metal according to claim 5 [7], wherein the process comprises dry-milling and then wet-milling an ion exchange resin.

11. (Amended) The abrasive for metal according to claim 1, wherein the metal is [a copper-based metal] copper or copper alloy.

13. (Amended) The polishing composition for metal according to claim 12, wherein the metal is [a copper-based metal] copper or copper alloy.

17. (Amended) The process according to claim 16, wherein the metal is [a copper-based metal] copper or copper alloy.